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Saito et al.

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(54) **SUBSTRATE PROCESSING SYSTEM**

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(73) Assignee: **TOKYO ELECTRON LIMITED**, Tokyo (JP)

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H01L 21/67 (2006.01)

(52) **U.S. Cl.**
CPC ***H01L 21/67778*** (2013.01); ***H01L 21/67178*** (2013.01); ***H01L 21/67781*** (2013.01)

(58) **Field of Classification Search**
CPC H01L 21/67778
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,893,171 B2 * 5/2005 Fukutomi H01L 21/67173 355/27
7,878,213 B2 * 2/2011 Mitsuyoshi B65G 49/061 134/133
8,023,099 B2 * 9/2011 Yamamoto G03F 7/0035 355/27
8,025,023 B2 * 9/2011 Hayashida G02F 1/130 118/300
8,031,324 B2 * 10/2011 Fukutomi H01L 21/67051 355/27
8,383,990 B2 * 2/2013 Morita H01L 21/67248 118/729
8,545,118 B2 * 10/2013 Ogura H01L 21/67196 396/611
8,851,008 B2 * 10/2014 Fukutomi H01L 21/6715 118/300
9,184,071 B2 * 11/2015 Ogura H01L 21/67173
2008/0129968 A1 * 6/2008 Hayashida G03F 7/3021 355/27
2008/0199283 A1 8/2008 Mitsuyoshi
2011/0078898 A1 * 4/2011 Ishida H01L 21/67051 29/771
2011/0082579 A1 * 4/2011 Yoshida G02F 21/67276 700/101
2013/0032179 A1 * 2/2013 Kaneko H01L 21/6715 134/133
2014/0152966 A1 * 6/2014 Hwang G03F 7/162 355/27
2015/0132086 A1 * 5/2015 Saito H01L 21/67178 414/222.13

FOREIGN PATENT DOCUMENTS

JP 5000627 B2 8/2012

* cited by examiner

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(57) **ABSTRACT**

A first transfer apparatus unloads and transfers substrates from a cassette. A first accommodating unit accommodates the substrates. First substrate processing units divided into at least two groups and arranged in a height direction performs a process to the substrates. Second accommodating units respectively corresponding to the groups are arranged to be parallel with the first accommodating unit in the height direction. Second transfer apparatuses respectively corresponding to the groups unload and transfer the substrates from the second accommodating units corresponding to the same groups into the first substrate processing units of the same groups. Second substrate processing units respectively corresponding to the groups are arranged to be parallel with the first and second accommodating units in the height direction. A delivery apparatus delivers the substrates between the first and second accommodating units and transfers the substrates between the first accommodating unit and the second substrate processing units.

4 Claims, 8 Drawing Sheets

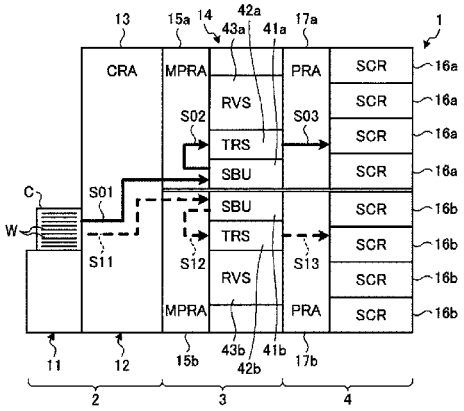


FIG. 1

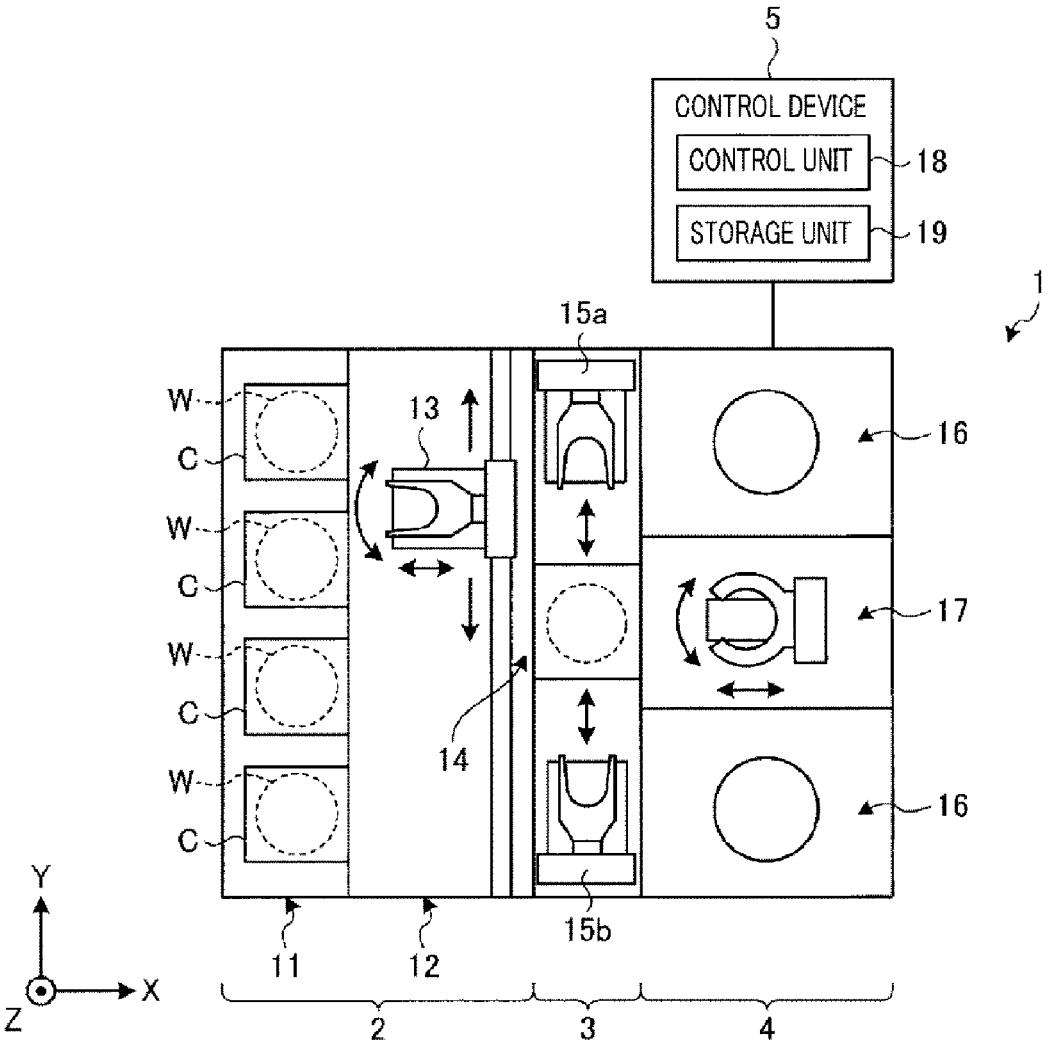

5
CONTROL DEVICE
CONTROL UNIT
18
STORAGE UNIT
19
1
15a
W
C
13
16
17
14
15b
11
12
2
3
4
Y
X
Z

FIG. 2

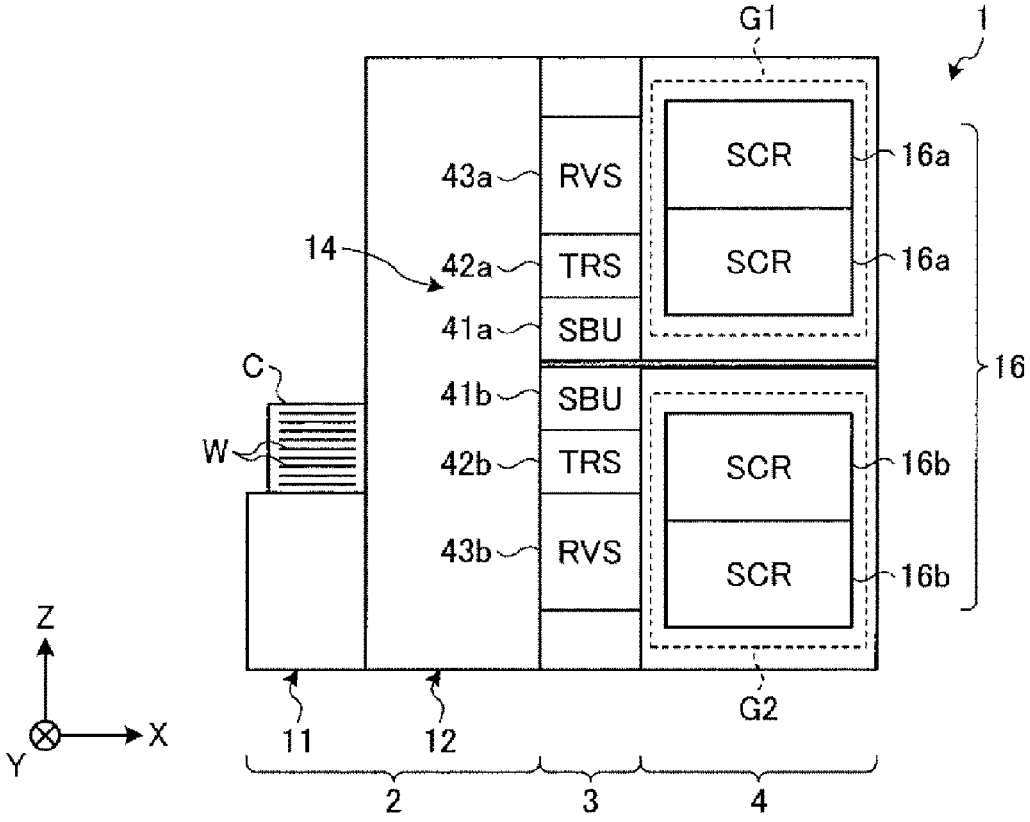

G1
1
43a
RVS
SCR
16a
14
42a
TRS
SCR
16a
41a
SBU
C
41b
SBU
16
W
42b
TRS
SCR
16b
43b
RVS
SCR
16b
Z
X
Y
11
12
G2
2
3
4

FIG. 3A

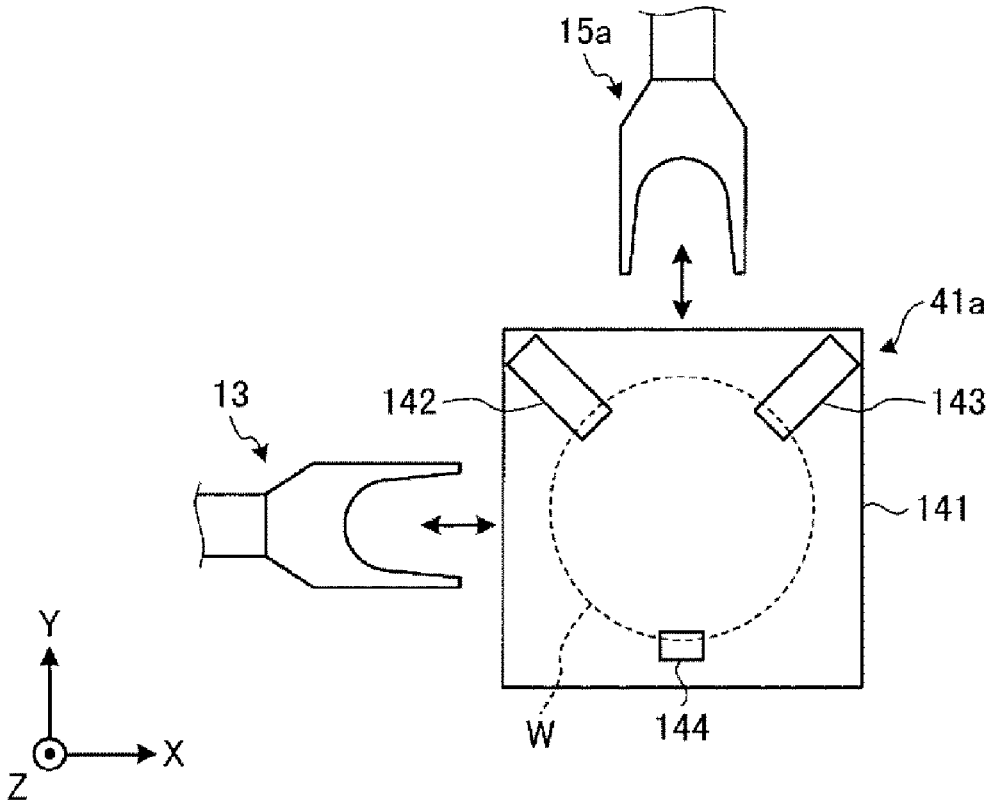


FIG. 3B

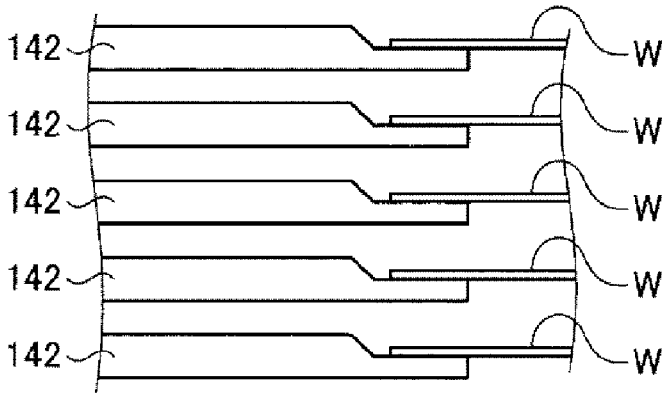


FIG. 4

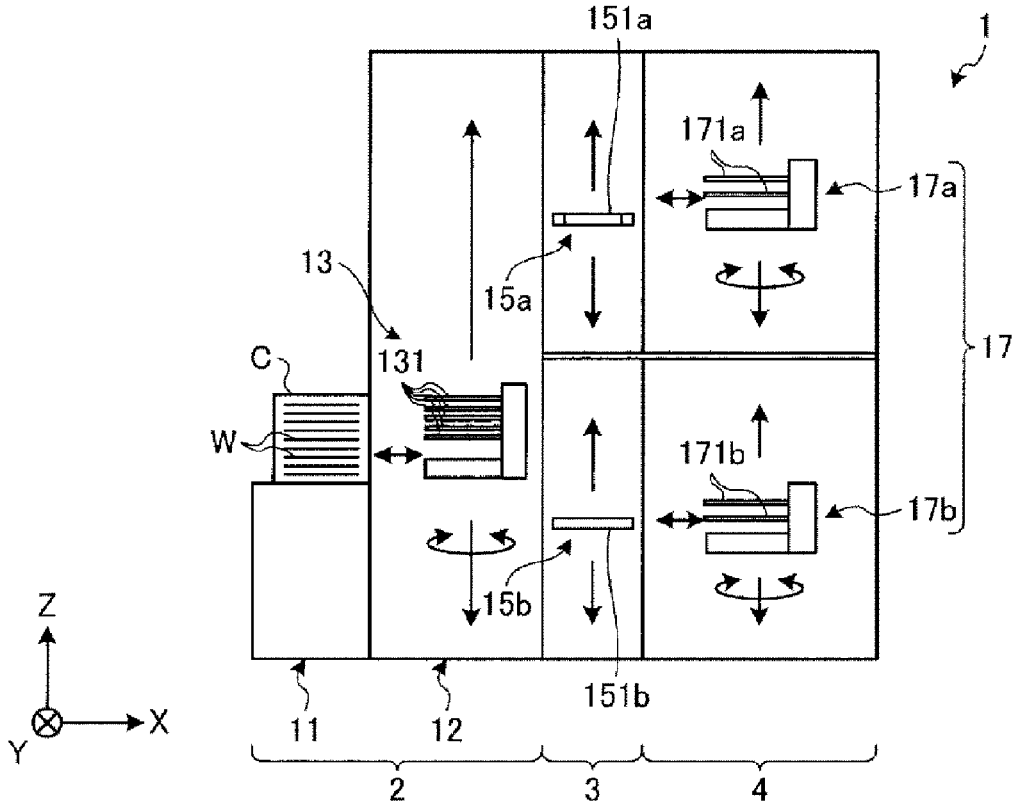


FIG. 5

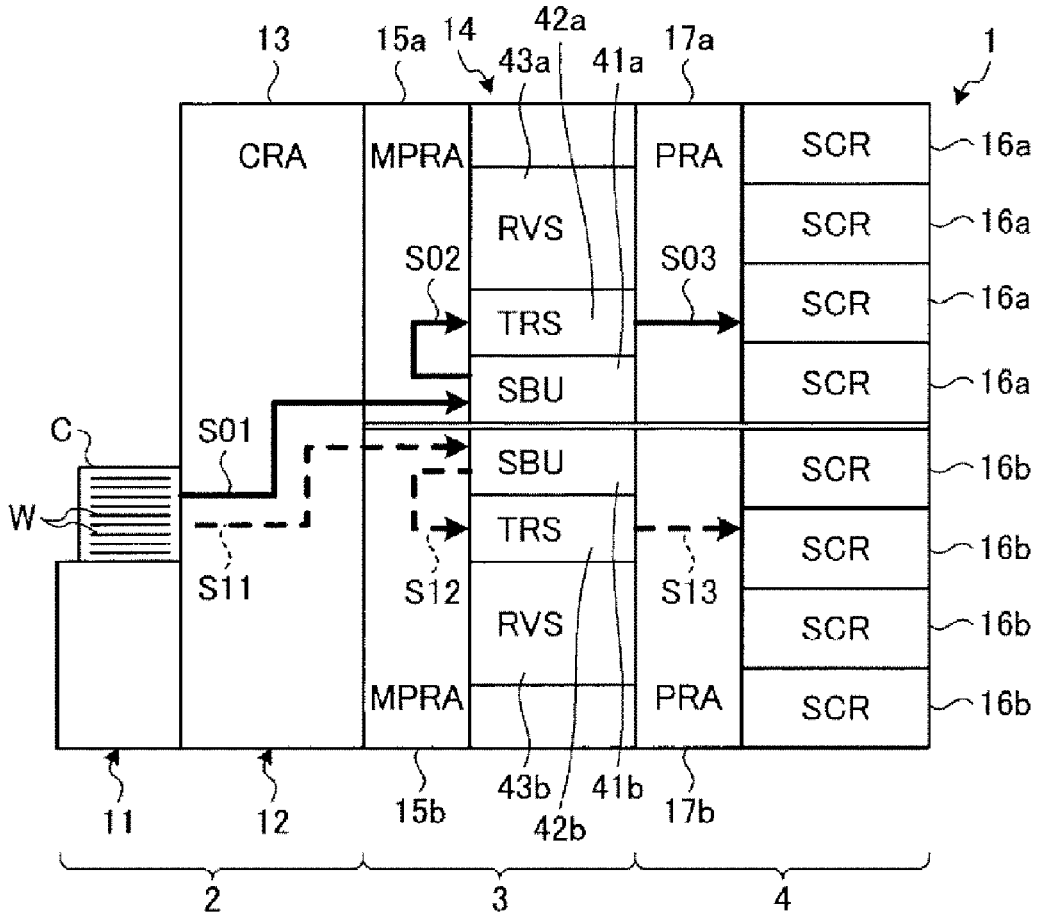
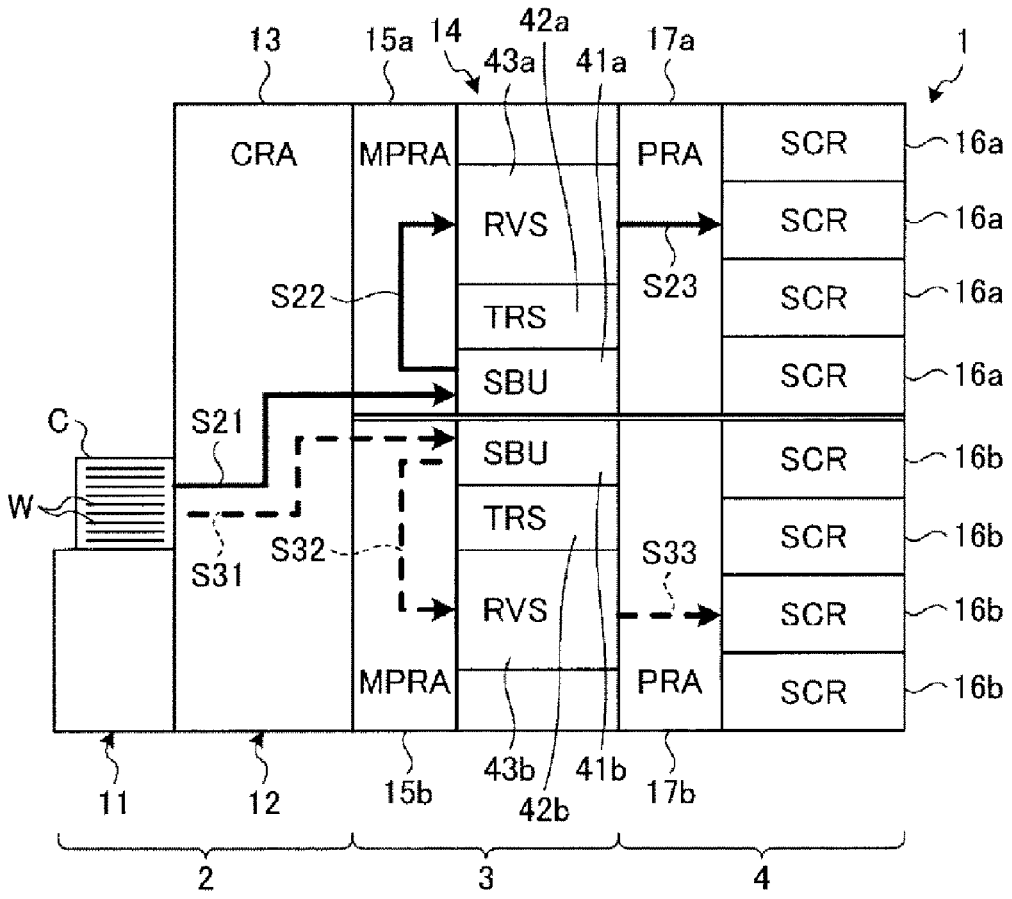

13
15a
14
42a
43a
41a
17a
1
CRA
MPRA
RVS
TRS
SBU
PRA
SCR
16a
16b
S01
S02
S03
S11
S12
S13
C
W
43b
41b
42b
15b
17b
11
12
2
3
4

FIG. 6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41a
17a
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PRA
SCR
16a
RVS
TRS
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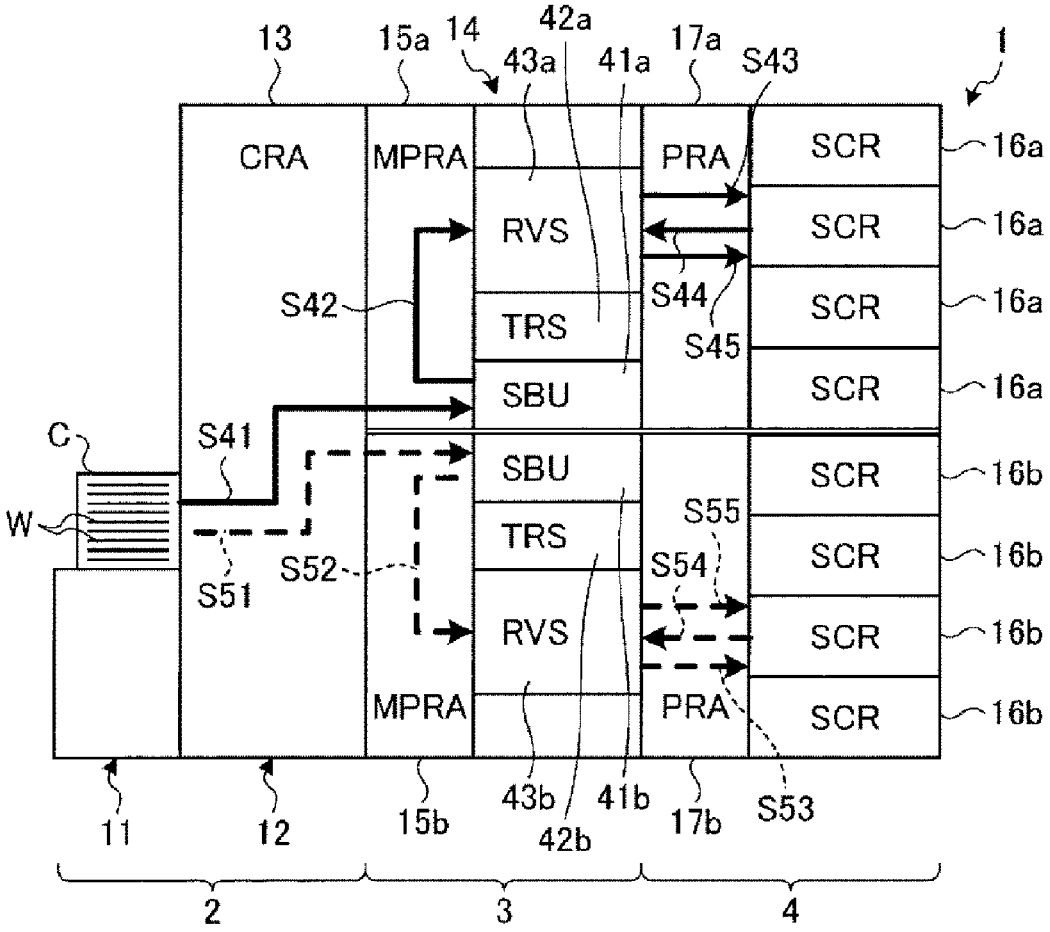
S22
S23
C
S21
W
S31
S32
S33
11
12
15b
43b
42b
41b
17b
16b
2
3
4

FIG. 7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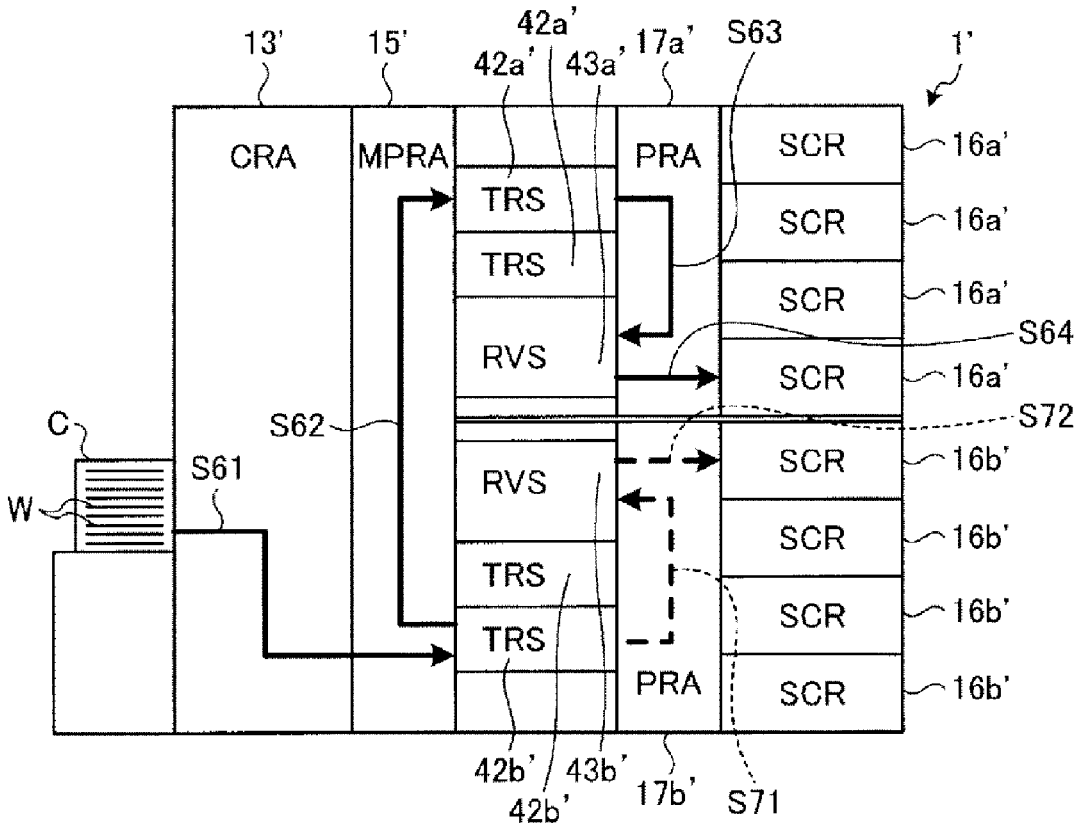
15a
14
42a
43a
41a
17a
S43
1
CRA
MPRA
PRA
SCR
16a
RVS
S42
S44
S45
TRS
SBU
C
S41
W
S51
S52
S55
S54
16b
11
12
15b
43b
42b
41b
17b
S53
2
3
4

FIG. 8
(PRIOR ART)



SUBSTRATE PROCESSING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Japanese Patent Application No. 2013-236271 filed on Nov. 14, 2013, the disclosures of which are incorporated herein by reference.

TECHNICAL FIELD

The embodiments described herein pertain generally to a substrate processing system.

BACKGROUND

Conventionally, there has been known a substrate processing system that performs a substrate process, such as a liquid process with a processing liquid or a gas process with a processing gas, to a substrate such as a semiconductor wafer, or the like.

By way of example, a substrate processing system described in Patent Document 1 includes multiple substrate processing units stacked in multiple stages, a substrate accommodating unit capable of accommodating multiple substrates loaded from the outside, two substrate transfer apparatuses stacked up and down to respectively correspond to an upper group and a lower group of the multiple substrate processing units and configured to unload substrates from the substrate accommodating unit and load the substrates into the substrate processing units, and a substrate delivery apparatus configured to deliver a substrate accommodated in the substrate accommodating unit to another position in the substrate accommodating unit.

In this substrate processing system, the substrates loaded from the outside are accommodated at an accommodation position in a lower portion within the substrate accommodating unit. Then, substrates, which are processed in the lower group of the substrate processing units, are unloaded by the substrate transfer apparatus corresponding to the lower group, and then, loaded into the lower group of the substrate processing units. Further, substrates, which are processed in the upper group of the substrate processing units, are delivered by the substrate delivery apparatus to an accommodation position in an upper portion within the substrate accommodating unit. Subsequently, the substrates are unloaded by the substrate transfer apparatus corresponding to the upper group, and then loaded into the upper group of the substrate processing units.

Further, the substrate processing system described in Patent Document 1 includes an inverting device configured to invert the front and rear surfaces of a substrate. A substrate accommodated in the substrate accommodating unit is unloaded by the substrate transfer apparatus and then loaded into the inverting device if necessary. Then, after the front and rear surfaces of the substrate are inverted in the inverting device, the substrate is loaded into the substrate processing unit.

Patent Document 1: Japanese Patent Publication No. 5000627

However, in the substrate processing system described in Patent Document 1, the substrate transfer apparatus transfers substrates to the substrate processing units and also transfers substrates from the substrate accommodating unit to the inverting device. As a result, a heavy load is applied to the substrate transfer apparatus. For this reason, it is difficult to

increase the number of wafers to be transferred per unit time in the substrate processing system.

Further, such a problem may occur, not only in the inverting device, but in a case where the substrate transfer apparatus accesses another processing unit such as an inspection device.

SUMMARY

In view of the foregoing, example embodiments provide a substrate processing system capable of increasing the number of sheets to be transferred per unit time.

In one example embodiment, a substrate processing system includes a first transfer apparatus configured to unload substrates from a cassette that accommodates the substrates and configured to transfer the unloaded substrates; a first accommodating unit configured to accommodate the substrates transferred by the first transfer apparatus; multiple first substrate processing units, which are divided into at least two groups and arranged in a height direction, configured to perform a preset process to the respective substrates; multiple second accommodating units, which respectively correspond to the groups and are arranged to be parallel with the first accommodating unit in the height direction, configured to accommodate the substrates; multiple second transfer apparatuses, respectively corresponding to the groups, configured to unload the substrates from the second accommodating units corresponding to the same groups and transfer the substrates into the first substrate processing units belonging to the same groups; multiple second substrate processing units, which respectively correspond to the groups and are arranged to be parallel with the first accommodating unit and the second accommodating units in the height direction, configured to perform a certain process to the respective substrates; and a delivery apparatus configured to deliver the substrates between the first accommodating unit and the second accommodating units and configured to transfer the substrates between the first accommodating unit and the second substrate processing units.

In accordance with the example embodiment, it is possible to increase the number of wafers to be transferred per unit time by reducing a processing load on the second transfer apparatuses.

The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description that follows, embodiments are described as illustrations only since various changes and modifications will become apparent to those skilled in the art from the following detailed description. The use of the same reference numbers in different figures indicates similar or identical items.

FIG. **1** is a diagram illustrating a configuration of a substrate processing system in accordance with a present example embodiment;

FIG. **2** is an arrangement diagram of a first accommodating unit, a second accommodating unit, an inverting unit, and a cleaning unit;

FIG. **3**A is a diagram illustrating a configuration of the first accommodating unit;

FIG. **3**B is a diagram illustrating a configuration of the first accommodating unit;

FIG. **4** is an arrangement diagram of a first transfer apparatus, a delivery apparatus, and a second transfer apparatus;

FIG. **5** is an explanatory diagram of showing a substrate transfer process in a case where a process is performed by the cleaning unit without performing a process by the inverting unit;

FIG. **6** is an explanatory diagram of showing a substrate transfer process in a case where a process is performed by the cleaning unit after a process is performed by the inverting unit;

FIG. **7** is an explanatory diagram of showing a substrate transfer process in a case where a process is performed by the inverting unit before and after a process is performed by the cleaning unit; and

FIG. **8** is an explanatory diagram of showing a substrate transfer process in a conventional substrate processing system.

DETAILED DESCRIPTION

In the following detailed description, reference is made to the accompanying drawings, which form a part of the description. In the drawings, similar symbols typically identify similar components, unless context dictates otherwise. Furthermore, unless otherwise noted, the description of each successive drawing may reference features from one or more of the previous drawings to provide clearer context and a more substantive explanation of the current example embodiment. Still, the example embodiments described in the detailed description, drawings, and claims are not meant to be limiting. Other embodiments may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented herein. It will be readily understood that the aspects of the present disclosure, as generally described herein and illustrated in the drawings, may be arranged, substituted, combined, separated, and designed in a wide variety of different configurations, all of which are explicitly contemplated herein.

Hereinafter, example embodiments of a substrate processing system will be explained in detail with reference to the accompanying drawings. Further, the present disclosure is not limited to the following example embodiments.

FIG. **1** is a diagram illustrating a configuration of a substrate processing system in accordance with a present example embodiment. Hereinafter, in order to clarify positional relationships, the X-axis, Y-axis and Z-axis directions are defined as being orthogonal to each other, and the positive direction of the Z-axis is regarded as a vertically upward direction.

As depicted in FIG. **1**, a substrate processing system **1** includes a loading/unloading station **2**, a delivery station **3**, and a processing station **4**.

The loading/unloading station **2** includes a carrier mounting unit **11** and a transfer unit **12**. On the carrier mounting unit **11**, multiple cassettes C each configured to accommodate multiple substrates, i.e., multiple semiconductor wafers (hereinafter, referred to as "wafers W") in the present example embodiment, in a horizontal posture.

The transfer unit **12** is arranged to be adjacent to the carrier mounting unit **11**, and includes a first transfer apparatus **13** therein. The first transfer apparatus **13** is configured to transfer the wafers W between the cassette C and the delivery station **3**.

The delivery station **3** is arranged to be adjacent to the loading/unloading station **2**, and includes a delivery block **14** and multiple delivery apparatuses **15***a* and **15***b* therein.

In the delivery block **14**, a first accommodating unit and a second accommodating unit each configured to accommodate the wafers W in multiple stages, and an inverting unit configured to invert the front and rear surfaces of the wafer W are stacked. The configuration of the delivery block **14** will be described in detail below.

The delivery apparatuses **15***a* and **15***b* are arranged to be adjacent to the delivery block **14**. To be specific, the delivery apparatus **15***a* is arranged to be adjacent to the delivery block **14** in the positive direction of the Y-axis, and the delivery apparatus **15***b* is arranged to be adjacent to the delivery block **14** in the negative direction of the Y-axis. Each of the delivery apparatuses **15***a* and **15***b* delivers the wafer W among the first and second accommodating units and the inverting unit arranged in the delivery block **14**.

The processing station **4** is arranged to be adjacent to the delivery station **3**, and includes multiple cleaning units **16** and multiple second transfer apparatuses **17**. The multiple cleaning units **16** are arranged to be adjacent to the second transfer apparatuses **17** in the positive direction and the negative direction of the Y-axis, respectively.

The multiple second transfer apparatuses **17** are stacked in two stages, i.e., upper and lower stages, and each of the second transfer apparatuses **17** is configured to transfer the wafer W between the delivery block **14** and the cleaning unit **16**.

In the present example embodiment, the cleaning unit **16** includes a brush device therein and is configured to perform a cleaning process to the wafer W transferred through the second transfer apparatus **17** by contacting the wafer W with the brush device. Further, the cleaning unit **16** may perform a cleaning process with a chemical liquid such as SC1 (a mixed solution of ammonia and hydrogen peroxide water). The cleaning unit **16** is an example of "first substrate processing unit".

Further, the substrate processing system **1** includes a control device **5**. The control device **5** is, for example, a computer, and includes a control unit **18** and a storage unit **19**. In the storage unit **19**, programs for controlling various processes to be performed in the substrate processing system **1** are stored. The control unit **18** reads and executes a program stored in the storage unit **19** to control an operation of the substrate processing system **1**.

Further, the programs may be stored, for example, in a computer-readable storage medium and installed from the storage medium into the storage unit **19** of the control device **5**. Examples of the computer-readable storage medium may include a hard disk (HD), flexible disk (FD), compact disk (CD), magneto-optical disk (MO), or memory card.

Hereinafter, the configuration of the delivery station **3** and the processing station **4** will be explained in detail. Arrangement of the first accommodating unit, the second accommodating unit, and the inverting unit provided in the delivery block **14** of the delivery station **3** and the cleaning unit **16** provided in the processing station **4** will be explained with reference to FIG. **2**. FIG. **2** is an arrangement diagram of the first accommodating unit, the second accommodating unit, the inverting unit, and the cleaning unit.

Further, in FIG. **2**, the cleaning units **16** are denoted by "SCR", the first accommodating units **41***a* and **41***b* are denoted by "SBU", the second accommodating units **42***a* and **42***b* are denoted by "TRS", and the inverting units **43***a* and **43***b* are denoted by "RVS". The inverting units **43***a* and **43***b* are examples of "second substrate processing units".

As illustrated in FIG. **2**, the multiple cleaning units **16** are arranged to be parallel with each other in four stages in a height direction. These cleaning units **16** are divided into two

groups arranged in the height direction (Z-axis direction). To be specific, upper two cleaning units **16***a* belong to an upper group G**1** and lower two cleaning units **16***b* belong to a lower group G**2**.

Further, the cleaning units **16** depicted in FIG. **2** respectively correspond to the cleaning units **16** arranged in the negative direction of the Y-axis of the second transfer apparatus **17** depicted in FIG. **1**. Although illustration is omitted herein, the cleaning units **16** arranged in the positive direction of the Y-axis of the second transfer apparatus **17** also have the same configuration of the cleaning units **16** depicted in FIG. **2**. Therefore, in the processing station **4**, in both the negative direction and the positive direction of the Y-axis of the second transfer apparatus **17**, four cleaning units **16***a* and **16***b* (eight in total) are arranged.

In the delivery block **14**, the two first accommodating units **41***a* and **41***b*, the two second accommodating units **42***a* and **42***b*, and the two inverting units **43***a* and **43***b* are stacked. Each of the first accommodating units **41***a* and **41***b* serves as a region where the wafers W loaded into the substrate processing system **1** by the first transfer apparatus **13** (see FIG. **1**) or the wafers W unloaded from the substrate processing system **1** by the first transfer apparatus **13** are temporarily accommodated.

Hereinafter, the configuration of the first accommodating units **41***a* and **41***b* will be explained with reference to FIG. **3**A and FIG. **3**B. FIG. **3**A and FIG. **3**B are diagrams illustrating a configuration of the first accommodating units **41***a* and **41***b*. Further, FIG. **3**A illustrates a configuration of the first accommodating unit **41***a* as an example, and the first accommodating unit **41***b* has the same configuration as the first accommodating unit **41***a*.

As illustrated in FIG. **3**A, the first accommodating unit **41***a* includes a base member **141** and three supporting members **142**, **143**, and **144** uprightly provided on the base member **141**. The three supporting members **142**, **143**, and **144** are arranged along a circumferential direction at regular intervals of about 120 degrees, and leading ends of the supporting members **142**, **143**, and **144** support an outer peripheral portion of the wafer W. Further, each of the supporting members **142**, **143**, and **144** is provided in plural stages along the height direction (see, for example, the multiple supporting members **142** illustrated in FIG. **3**B). Thus, the first accommodating unit **41***a* may accommodate multiple wafers W in multiple stages.

The first transfer apparatus **13** and the delivery apparatus **15***a* access the first accommodating unit **41***a* in respectively different directions. To be specific, the first transfer apparatus **13** enters the first accommodating unit **41***a* while passing through spaces between the supporting members **142** and the supporting members **144** from the negative direction of the X-axis of the first accommodating unit **41***a*. Further, the delivery apparatus **15***a* enters the first accommodating unit **41***a* while passing through spaces between the supporting members **142** and the supporting members **143** from the positive direction of the Y-axis of the first accommodating unit **41***a*.

As depicted in FIG. **2**, as for the first accommodating units **41***a* and **41***b*, the second accommodating units **42***a* and **42***b*, and the inverting units **43***a* and **43***b*, the inverting unit **43***b*, the second accommodating unit **42***b*, the first accommodating unit **41***b*, the first accommodating unit **41***a*, the second accommodating unit **42***a*, and the inverting unit **43***a* are stacked in sequence from the bottom.

The first accommodating unit **41***a*, the second accommodating unit **42***a*, and the inverting unit **43***a* arranged at an upper portion of the delivery block **14** correspond to the upper group G**1**, and the first accommodating unit **41***b*, the second accommodating unit **42***b*, and the inverting unit **43***b* arranged at a lower portion of the delivery block **14** correspond to the lower group G**2**.

To be specific, wafers W processed or to be processed in the cleaning units **16***a* belonging to the upper group G**1** are loaded into the first accommodating unit **41***a*, the second accommodating unit **42***a*, and the inverting unit **43***a* corresponding to the upper group G**1**. Further, wafers W processed or to be processed in the cleaning units **16***b* belonging to the lower group G**2** are loaded into the first accommodating unit **41***b*, the second accommodating unit **42***b*, and the inverting unit **43***b* corresponding to the lower group G**2**.

Herein, one first accommodating unit, one second accommodating unit, and one inverting unit are provided in each of the groups G**1** and G**2**. However, multiple first accommodating units, multiple second accommodating units, and multiple inverting units may be provided in each of the groups G**1** and G**2**.

Hereinafter, arrangement of the first transfer apparatus **13**, the delivery apparatuses **15***a* and **15***b*, and the second transfer apparatus **17** will be explained with reference to FIG. **4**. FIG. **4** is an arrangement diagram of the first transfer apparatus **13**, the delivery apparatuses **15***a* and **15***b*, and the second transfer apparatus **17**.

The delivery apparatus **15***a* is arranged to be adjacent to the delivery block **14** in the positive direction of the Y-axis, and the delivery apparatus **15***b* is arranged to be adjacent to the delivery block **14** in the negative direction of the Y-axis (see FIG. **1**). Further, the second transfer apparatus **17** is arranged between the cleaning unit **16** provided at the positive direction side of the Y-axis of the processing station **4** and the cleaning units **16** provided at the negative direction side of the Y-axis thereof (see FIG. **1**). Meanwhile, the both delivery apparatuses **15***a* and **15***b* may be arranged at one side in the positive direction or negative direction of the Y-axis of the delivery block **14**.

As depicted in FIG. **4**, the first transfer apparatus **13** includes multiple (herein, five) wafer holding units **131** each configured to hold thereon the wafer W. Further, the first transfer apparatus **13** can be delivered in a horizontal direction and a vertical direction and can be rotated around a vertical axis, and can also transfer multiple wafers W at the same time between the cassette C and the first accommodating units **41***a* and **41***b* through the wafer holding units **131**.

The delivery apparatuses **15***a* and **15***b* respectively transfer the wafers W between the first accommodating units **41***a* and **41***b* and the second accommodating units **42***a* and **42***b* or between the first accommodating units **41***a* and **41***b* and the inverting units **43***a* and **43***b* depicted in FIG. **2**.

To be specific, the delivery apparatus **15***a* corresponds to the upper group G**1** and transfers a wafer W with a wafer holding unit **151***a* between the first accommodating unit **41***a* and the second accommodating unit **42***a* or between the first accommodating unit **41***a* and the inverting unit **43***a* corresponding to the same upper group G**1**. Further, the delivery apparatus **15***b* corresponds to the lower group G**2** and transfers a wafer W with a wafer holding unit **151***b* between the first accommodating unit **41***b* and the second accommodating unit **42***b* or between the first accommodating unit **41***b* and the inverting unit **43***b* corresponding to the same lower group G**2**.

The delivery apparatus **15***a* is arranged above the delivery apparatus **15***b*. To be specific, the delivery apparatus **15***a* corresponding to the upper group G**1** is arranged at substantially the same height position as the first accommodating unit **41***a*, the second accommodating unit **42***a*, and the inverting unit **43***a* corresponding to the same upper group G**1**. Further, the delivery apparatus **15***b* corresponding to the lower group

G2 is arranged at substantially the same height position as the first accommodating unit **41***b*, the second accommodating unit **42***b*, and the inverting unit **43***b* corresponding to the same lower group G2.

The second transfer apparatuses **17***a* and **17***b* are stacked in two stages, i.e., upper and lower stages. The second transfer apparatus **17***a* includes multiple (herein, two) wafer holding units **171***a* each configured to hold thereon a wafer W. Likewise, the second transfer apparatus **17***b* includes multiple (herein, two) wafer holding units **171***b* each configured to hold thereon a wafer W. Further, the second transfer apparatuses **17***a* and **17***b* can be delivered in the horizontal direction and the vertical direction, and respectively transfer wafers W with the wafer holding units **171***a* and **171***b* between the second accommodating units **42***a* and **42***b* and the cleaning units **16***a* and **16***b* or between the inverting units **43***a* and **43***b* and the cleaning units **16***a* and **16***b*. The second transfer apparatuses **17***a* and **17***b* respectively use the lower wafer holding units **171***a* and **171***b* in order to load wafers W into each unit, and respectively use the upper wafer holding units **171***a* and **171***b* in order to unload wafers W from each unit.

In the second transfer apparatuses **17***a* and **17***b*, the second transfer apparatus **17***a* arranged in an upper portion of the processing station **4** corresponds to the upper group G1, and transfers a wafer W between the second accommodating unit **42***a* and the cleaning unit **16***a* or between the inverting unit **43***a* and the cleaning unit **16***a* corresponding to the same upper group G1. Further, in the second transfer apparatuses **17***a* and **17***b*, the second transfer apparatus **17***b* arranged in a lower portion of the processing station **4** corresponds to the lower group G2, and transfers a wafer W between the second accommodating unit **42***b* and the cleaning unit **16***b* or between the inverting unit **43***b* and the cleaning unit **16***b* corresponding to the same lower group G2.

Hereinafter, there will be explained a process sequence of a substrate transfer process performed by the substrate processing system **1** in accordance with the present example embodiment. There will be first explained a process sequence of a substrate transfer process in a case where a process is performed by the cleaning units **16***a* and **16***b* without performing a process by the inverting units **43***a* and **43***b* with reference to FIG. **5**.

FIG. **5** is an explanatory diagram of showing a substrate transfer process in a case where a process is performed by the cleaning units **16***a* and **16***b* without performing a process by the inverting units **43***a* and **43***b*. Further, the substrate transfer process illustrated in FIG. **5** is performed, for example, when only a front surface of a wafer W is cleaned.

Herein, in FIG. **5**, the first transfer apparatus **13** is denoted by "CRA", the delivery apparatuses **15***a* and **15***b* are denoted by "MPRA", and the second transfer apparatuses **17***a* and **17***b* are denoted by "PRA". Further, in FIG. **5**, for easier understanding, the delivery apparatuses **15***a* and **15***b* provided between the first transfer apparatus **13** and the delivery block **14**, and the second transfer apparatuses **17***a* and **17***b* provided between the delivery block **14** and the cleaning units **16***a* and **16***b* are conveniently illustrated.

As depicted in FIG. **5**, in the substrate processing system **1**, the first transfer apparatus **13** collectively unloads five unprocessed wafers W from the cassette C to accommodate the wafers W in the first accommodating unit **41***a* corresponding to the upper group G1 (S**01**). Further, the first transfer apparatus **13** collectively unloads five unprocessed wafers W again from the cassette C to accommodate the wafers W in the first accommodating unit **41***b* corresponding to the lower group G2 (S**11**). As such, the first transfer apparatus **13** alternately performs the process of accommodating unprocessed wafers W unloaded from the cassette C in the first accommodating unit **41***a* and the process of accommodating unprocessed wafers W unloaded from the cassette C in the first accommodating unit **41***b*.

Then, the delivery apparatus **15***a* corresponding to the upper group G1 unloads the unprocessed wafers W one by one from the first accommodating unit **41***a* corresponding to the upper group G1 and delivers the unloaded wafers W to the second accommodating unit **42***a* corresponding to the upper group G1 (S**02**). Further, the delivery apparatus **15***b* corresponding to the lower group G2 unloads the unprocessed wafers W one by one from the first accommodating unit **41***b* corresponding to the lower group G2 and delivers the unloaded wafers W to the second accommodating unit **42***b* corresponding to the lower group G2 (S**12**).

As depicted in FIG. **5**, the first accommodating units **41***a* and **41***b* are arranged at a middle height position between the upper group G1 and the lower group G2 arranged adjacent to each other. The system in the present example embodiment includes only these two groups. Thus, the middle height position is equivalent to an middle height position in the delivery block **14**. To be specific, the first accommodating units **41***a* and **41***b* are stacked in upper and lower two stages between the second accommodating unit **42***a* and the inverting unit **43***a* corresponding to the upper group G1 and the second accommodating unit **42***b* and the inverting unit **43***b* corresponding to the lower group G2. In the present example embodiment, the bottom surface of the first accommodating unit **41***a* has the same height position as the bottom surface of the upper group G1, and the top surface of the second accommodating unit **41***b* has the same height position as the top surface of the second group G2.

Further, the second accommodating unit **42***a* corresponding to the upper group G1 is arranged on the first accommodating unit **41***a* corresponding to the upper group G1, and the second accommodating unit **42***b* corresponding to the lower group G2 is arranged below the first accommodating unit **41***b* corresponding to the lower group G2.

The first accommodating units **41***a* and **41***b* are arranged at the middle height position in the delivery block **14** and the second accommodating units **42***a* and **42***b* are arranged on and below the first accommodating units **41***a* and **41***b*, respectively. As a result, it is possible to shorten moving distances of the delivery apparatuses **15***a* and **15***b* when the wafers W are delivered from the first accommodating units **41***a* and **41***b* to the second accommodating units **42***a* and **42***b*, respectively. Further, with the configuration as described above, a moving distance of the delivery apparatus **15***a* corresponding to the upper group G1 can be equivalent to a moving distance of the delivery apparatus **15***b* corresponding to the lower group G2, and, thus, it is possible to suppress a difference in processing times between the groups G1 and G2.

Then, the unprocessed wafers W accommodated in the second accommodating unit **42***a* are unloaded one by one by the second transfer apparatus **17***a* corresponding to the upper group G1 from the second accommodating unit **42***a* and transferred into the cleaning unit **16***a* of the upper group G1 (S**03**). Likewise, the unprocessed wafers W accommodated in the second accommodating unit **42***b* are unloaded one by one by the second transfer apparatus **17***b* corresponding to the lower group G2 from the second accommodating unit **42***b* and transferred into the cleaning unit **16***b* of the lower group G2 (S**13**). Then, the wafers W transferred into the cleaning units **16***a* and **16***b* are cleaned by the cleaning units **16***a* and **16***b*, respectively.

Then, the wafers W processed by the cleaning units **16***a* and **16***b* are accommodated in the cassette C in a reverse

sequence in which they are loaded. By way of example, the wafers W cleaned by the cleaning unit **16***a* of the upper group G**1** are unloaded one by one by the second transfer apparatus **17***a* corresponding to the upper group G**1** from the cleaning unit **16***a* and transferred to the second accommodating unit **42***a* corresponding to the upper group G**1**. Then, the delivery apparatus **15***a* corresponding to the upper group G**1** unloads the wafers W one by one from the second accommodating unit **42***a* and delivers the unloaded wafers W to the first accommodating unit **41***a*, and the first transfer apparatus **13** collectively unloads the five wafers W from the first accommodating unit **41***a* to load the wafers W back to the cassette C. The same operations may be applied to the lower group G**2**. Among the above-described operations, the operations of transferring and delivering substrates from when the substrates are placed in the first accommodating unit **41***a* corresponding to the upper group G**1** to when the substrates are placed in the first accommodating unit **41***a* again and the operations of transferring and delivering substrates from when the substrates are placed in the first accommodating unit **41***b* corresponding to the lower group G**2** to when the substrates are placed in the first accommodating unit **41***b* again are carried out at the same time in parallel.

Hereinafter, there will be explained a process sequence of a substrate transfer process in a case where a process is performed by the cleaning units **16***a* and **16***b* after a process is performed by the inverting units **43***a* and **43***b* with reference to FIG. **6**.

FIG. **6** is an explanatory diagram of showing a substrate transfer process in a case where a process is performed by the cleaning units **16***a* and **16***b* after a process is performed by the inverting units **43***a* and **43***b*. Further, the substrate transfer process illustrated in FIG. **6** is performed, for example, when a rear surface of a wafer W is cleaned.

As depicted in FIG. **6**, the first transfer apparatus **13** collectively unloads five unprocessed wafers W from the cassette C to accommodate the wafers W in the first accommodating unit **41***a* corresponding to the upper group G**1** (S**21**). Further, the first transfer apparatus **13** collectively unloads five unprocessed wafers W again from the cassette C to accommodate the wafers W in the first accommodating unit **41***b* corresponding to the lower group G**2** (S**31**).

Then, the delivery apparatus **15***a* corresponding to the upper group G**1** unloads the unprocessed wafers W one by one from the first accommodating unit **41***a* corresponding to the upper group G**1** and transfers the unloaded wafers W to the inverting unit **43***a* corresponding to the upper group G**1** (S**22**). Further, the delivery apparatus **15***b* corresponding to the lower group G**2** unloads the unprocessed wafers W one by one from the first accommodating unit **41***b* corresponding to the lower group G**2** and transfers the unloaded wafers W to the inverting unit **43***b* corresponding to the lower group G**2** (S**32**). The front and rear surfaces of the wafer W transferred to the inverting units **43***a* and **43***b* are inverted by the inverting units **43***a* and **43***b*.

Further, the second transfer apparatus **17***a* corresponding to the upper group G**1** unloads the inverted wafers W one by one from the inverting unit **43***a* corresponding to the upper group G**1** and transfers the unloaded wafers W to the cleaning unit **16***a* corresponding to the upper group G**1** (S**23**). Further, the second transfer apparatus **17***b* corresponding to the lower group G**2** unloads the inverted wafers W one by one from the inverting unit **43***b* corresponding to the lower group G**2** and transfers the unloaded wafers W to the cleaning unit **16***b* corresponding to the lower group G**2** (S**33**).

The cleaned wafers W are unloaded one by one from the cleaning units **16***a* and **16***b* by the second transfer apparatuses **17***a* and **17***b* and transferred to the second accommodating units **42***a* and **42***b*, respectively. Then, the wafers W are transferred one by one from the second accommodating units **42***a* and **42***b* to the first accommodating units **41***a* and **41***b* by the delivery apparatuses **15***a* and **15***b*, and then, the first transfer apparatus **13** collectively unloads five wafers W from the first accommodating units **41***a* and **41***b* to transfer the wafers W to the cassette C. Among the above-described operations, the operations of transferring and delivering substrates from when the substrates are placed in the first accommodating unit **41***a* corresponding to the upper group G**1** to when the substrates are placed in the first accommodating unit **41***a* again and the operations of transferring and delivering substrates from when the substrates are placed in the first accommodating unit **41***b* corresponding to the lower group G**2** to when the substrates are placed in the first accommodating unit **41***b* again are carried out at the same time in parallel.

As such, in the substrate processing system **1** in accordance with the present example embodiment, wafers W are transferred from the first accommodating units **41***a* and **41***b* to the inverting units **43***a* and **43***b* by the delivery apparatuses **15***a* and **15***b* instead of the second transfer apparatuses **17***a* and **17***b*, respectively. Thus, a processing load on the second transfer apparatuses **17***a* and **17***b* can be reduced. Therefore, even if an inverting process is performed, it is possible to increase the number of wafers to be transferred per unit time.

Further, in the substrate processing system **1** in accordance with the present example embodiment, the inverting unit **43***a* corresponding to the upper group G**1** is arranged on the second accommodating unit **42***a* corresponding to the upper group G**1**, and the inverting unit **43***b* corresponding to the lower group G**2** is arranged below the second accommodating unit **42***b* corresponding to the lower group G**2**.

As such, the inverting units **43***a* and **43***b* are arranged farther from the first accommodating units **41***a* and **41***b* than the second accommodating units **42***a* and **42***b* corresponding to the same groups G**1** and G**2**, respectively. For this reason, as compared with a case where the inverting units **43***a* and **43***b* are respectively arranged between the first accommodating units **41***a* and **41***b* and the second accommodating units **42***a* and **42***b*, it is possible to shorten moving distances of the delivery apparatuses **15***a* and **15***b* when the wafers W are delivered from the first accommodating units **41***a* and **41***b* to the second accommodating units **42***a* and **42***b*, respectively.

Herein, it is possible to consider that by arranging the inverting units **43***a* and **43***b* between the first accommodating units **41***a* and **41***b* and the second accommodating units **42***a* and **42***b*, moving distances of the delivery apparatuses **15***a* and **15***b* can be shortened when the wafers W are delivered from the first accommodating units **41***a* and **41***b* to the inverting units **43***a* and **43***b*.

However, the second accommodating units **42***a* and **42***b* are used in any one of a case where only a front surface of a wafer W is cleaned, a case where only a rear surface of the wafer W is cleaned, and a case where both surfaces of the wafer W are cleaned, which will be described below, whereas the inverting units **43***a* and **43***b* may not be used in some cases, for example, as depicted in FIG. **4**.

Therefore, by setting distances between the second accommodating units **42***a* and **42***b* and the first accommodating units **41***a* and **41***b* to be shorter than those between the inverting units **43***a* and **43***b* and the first accommodating units **41***a* and **41***b*, moving distances of the delivery apparatuses **15***a* and **15***b* can be shortened when the wafers W are delivered from the first accommodating units **41***a* and **41***b* to the second accommodating units **42***a* and **42***b*, which is effective in

increasing the number of wafers to be transferred per unit time in the substrate transfer process.

Further, as depicted in FIG. **5** and the like, the inverting units **43***a* and **43***b* has greater heights than the second accommodating units **42***a* and **42***b*, respectively. For this reason, if the inverting units **43***a* and **43***b* are interposed between the first accommodating units **41***a* and **41***b* and the second accommodating units **42***a* and **42***b*, the moving distances of the delivery apparatuses **15***a* and **15***b* are greatly increased when the wafers W are delivered from the first accommodating units **41***a* and **41***b* to the second accommodating units **42***a* and **42***b*. For this reason, it is desirable to set distances between the second accommodating units **42***a* and **42***b* and the first accommodating units **41***a* and **41***b* to be shorter than those between the inverting units **43***a* and **43***b* and the first accommodating units **41***a* and **41***b*. With such arrangement, it is possible to increase the number of wafers to be transferred per unit time.

Hereinafter, there will be explained a process sequence of a substrate transfer process in a case where a process is performed by the inverting units **43***a* and **43***b* before and after a process is performed by the cleaning units **16***a* and **16***b* with reference to FIG. **7**.

FIG. **7** is an explanatory diagram of showing a substrate transfer process in a case where a process is performed by the inverting units **43***a* and **43***b* before and after a process is performed by the cleaning units **16***a* and **16***b*. Further, the substrate transfer process illustrated in FIG. **7** is performed, for example, when both surfaces of a wafer W are cleaned. In the present example embodiment, two of the four the cleaning units **16***a* are assigned for cleaning the front surface, and the other two cleaning units **16***a* are assigned for cleaning the rear surface. The cleaning units **16***b* are assigned in the same manner.

Processes S**41** to S**43** and processes S**51** to S**53** as depicted in FIG. **7** show a process sequence from when front and rear surfaces of unprocessed wafers W are inverted to when the wafers W are transferred to cleaning units **16***a* and **16***b*, and these are the same as processes S**21** to S**23** and processes S**31** to S**33**, respectively, as depicted in FIG. **6**.

The wafers W of which rear surfaces are cleaned by the cleaning unit **16***a* belonging to the upper group G**1** are unloaded one by one from the cleaning unit **16***a* by the second transfer apparatus **17***a* corresponding to the upper group G**1** to be transferred again to the inverting unit **43***a* corresponding to the upper group G**1** (S**44**). Front and rear surfaces of the wafers W transferred to the inverting unit **43***a* are inverted by the inverting unit **43***a*, and then, the wafers W are unloaded one by one by the second transfer apparatus **17***a* to be transferred again to the cleaning unit **16***a* (S**45**). The front surfaces of the wafers W are cleaned by the cleaning unit **16***a*.

Likewise, the wafers W of which rear surfaces are cleaned by the cleaning unit **16***b* belonging to the lower group G**2** are unloaded one by one from the cleaning unit **16***b* by the second transfer apparatus **17***b* to be transferred again to the inverting unit **43***b* (S**54**). Then, front and rear surfaces of the wafers W are inverted by the inverting unit **43***b*, and then, the wafers W are transferred one by one again to the cleaning unit **16***b* by the second transfer apparatus **17***b* (S**55**). The front surfaces of the wafers W are cleaned by the cleaning unit **16***b*.

As such, wafers W are transferred between the cleaning units **16***a* and **16***b* and the inverting units **43***a* and **43***b* by the second transfer apparatuses **17***a* and **17***b*, respectively. Among the above-described operations, the operations of transferring and delivering substrates from when the substrates are placed in the first accommodating unit **41***a* corresponding to the upper group G**1** to when the substrates are placed in the first accommodating unit **41***a* again and the operations of transferring and delivering substrates from when the substrates are placed in the first accommodating unit **41***b* corresponding to the lower group G**2** to when the substrates are placed in the first accommodating unit **41***b* again are carried out at the same time in parallel.

Hereinafter, there will be explained a comparison between the substrate transfer processes performed in the conventional substrate processing system and in the substrate processing system **1** in accordance with the present example embodiment. FIG. **8** is an explanatory diagram of showing a substrate transfer process in the conventional substrate processing system. Further, FIG. **8** shows a process sequence of a substrate transfer process in a case where a process is performed by cleaning units **16***a*' and **16***b*' after a process is performed by inverting units **43***a*' and **43***b*'.

As depicted in FIG. **8**, in the conventional substrate processing system **1**', as for second accommodating units **42***a*' and **42***b*' and inverting units **43***a*' and **43***b*', the second accommodating unit **42***b*', the second accommodating unit **42***b*', the inverting unit **43***b*', the inverting unit **43***a*', the second accommodating unit **42***a*', and the second accommodating unit **42***a*' are stacked in sequence from the bottom. Further, the conventional substrate processing system **1**' includes a single delivery apparatus **15**'.

In the conventional substrate processing system **1**', a first transfer apparatus **13**' unloads unprocessed wafers W from the cassette C to accommodate the wafers W in the second accommodating unit **42***b*' corresponding to the lower group (S**61**). The first transfer apparatus **13**' repeats the above-described unloading process regardless of whether the wafers W are supposed to be processed by the cleaning unit **16***a*' corresponding to the upper group or by the cleaning unit **16***b*' corresponding to the lower group.

Then, a delivery apparatus **15**' unloads the wafers W to be processed by the cleaning unit **16***a*' corresponding to the upper group from the second accommodating unit **42***b*' corresponding to the lower group to deliver the unloaded wafers W to the second accommodating unit **42***a*' corresponding to the upper group (S**62**).

As such, in the conventional substrate processing system **1**', the single delivery apparatus **15**' accesses both of the second accommodating unit **42***b*' corresponding to the lower group and the second accommodating unit **42***a*' corresponding to the upper group. Therefore, a moving distance of the delivery apparatus **15**' is increased. This is one of factors that hinder an increase in the number of wafers to be transferred per unit time.

In contrast, the substrate processing system **1** in accordance with the present example embodiment includes the delivery apparatus **15***a* corresponding to the upper group G**1** and the delivery apparatus **15***b* corresponding to the lower group G**2**, respectively. Further, the first accommodating units **41***a* and **41***b* are arranged at the middle height position in the delivery block **14**. Further, the second accommodating unit **42***a* is arranged on the first accommodating unit **41***a* and the second accommodating unit **42***b* is arranged below the first accommodating unit **41***b*. Thus, in the substrate processing system **1** in accordance with the present example embodiment, moving distances of the delivery apparatuses **15***a* and **15***b* can be decreased. Therefore, it is possible to increase the number of wafers to be transferred per unit time.

Then, the second transfer apparatus **17***a*' corresponding to the upper group unloads the wafers W from the second accommodating unit **42***a*' corresponding to the upper group and transfers the unloaded wafers W to the inverting unit **43***a*' corresponding to the upper group (S**63**). Then, the second

transfer apparatus **17***a*' unloads the wafers W, of which front and rear surfaces of the wafers W are inverted by the inverting unit **43***a*', from the inverting unit **43***a*' and transfers the wafers W to the cleaning unit **16***a*' belonging to the upper group (S**64**).

Likewise, the second transfer apparatus **17***b*' corresponding to the lower group unloads the wafers W from the second accommodating unit **42***b*' corresponding to the lower group and transfers the unloaded wafers W to the inverting unit **43***b*' corresponding to the lower group (S**71**). Then, the second transfer apparatus **17***b*' unloads the wafers W, of which front and rear surfaces of the wafers W are inverted by the inverting unit **43***b*', from the inverting unit **43***b*' and transfers the wafers W to the cleaning unit **16***b*' belonging to the lower group (S**72**).

As such, in the conventional substrate processing system **1**', the wafers W are transferred from the second accommodating units **42***a*' and **42***b*' to the inverting units **43***a*' and **43***b*' by the second transfer apparatuses **17***a*' and **17***b*', respectively. Thus, a heavy processing load is applied on the second transfer apparatuses **17***a*' and **17***b*'.

In contrast, in the substrate processing system **1** in accordance with the present example embodiment, the delivery apparatuses **15***a* and **15***b* deliver the wafers W accommodated in the first accommodating units **41***a* and **41***b* to the inverting units **43***a* and **43***b*, respectively. Thus, in the substrate processing system **1** in accordance with the present example embodiment, it is possible to reduce a processing load on the second transfer apparatuses **17***a* and **17***b*. Therefore, it is possible to increase the number of wafers to be transferred per unit time.

As described above, the substrate processing system **1** in accordance with the present example embodiment includes the first transfer apparatus **13**, the first accommodating units **41***a* and **41***b*, the multiple cleaning units **16***a* and **16***b* (corresponding to examples of "first substrate processing units"), the multiple second accommodating units **42***a* and **42***b*, the multiple second transfer apparatuses **17***a* and **17***b*, the multiple inverting units **43***a* and **43***b* (corresponding to examples of "second substrate processing units"), and the delivery apparatuses **15***a* and **15***b*.

The first transfer apparatus **13** unloads wafers W from the cassette C, which accommodates multiple wafers W therein, and transfers the wafers W. The first accommodating units **41***a* and **41***b* accommodate the wafers W transferred by the first transfer apparatus **13**. The multiple cleaning units **16***a* and **16***b* are stacked in multiple stages, and divided into at least two groups arranged in a height direction. Further, each of the cleaning units **16***a* and **16***b* is configured to perform a cleaning process to the wafers W. The multiple second accommodating units **42***a* and **42***b* respectively corresponding to the groups are arranged to be parallel with the first accommodating units **41***a* and **41***b* at the overlapped positions in the height direction, and configured to accommodate the wafers W. The multiple second transfer apparatuses **17***a* and **17***b* respectively corresponding to the groups unload the wafers W from the second accommodating units **42***a* and **42***b* corresponding to the same groups and transfers the wafers W into the cleaning units **16***a* and **16***b* belonging to the same groups, respectively. The multiple inverting units **43***a* and **43***b* respectively corresponding to the groups are arranged to be parallel with the first accommodating units **41***a* and **41***b* and the second accommodating units **42***a* and **42***b* at the overlapped positions in the height direction, and configured to invert the front and rear surfaces of the wafers W. The delivery apparatuses **15***a* and **15***b* deliver the wafers W accommodated in the first accommodating units **41***a* and **41***b* to the second accommodating units **42***a* and **42***b* or deliver the wafers W to the inverting units **43***a* and **43***b*, respectively.

Thus, a processing load on the second transfer apparatuses **17***a* and **17***b* can be reduced. Therefore, it is possible to increase the number of wafers to be transferred per unit time.

Further, in the substrate processing system **1** in accordance with the present example embodiment, the first accommodating units **41***a* and **41***b* are arranged at the middle height position in the delivery block **14** (corresponding to an example of "processing block") including the first accommodating units **41***a* and **41***b* and the second accommodating units **42***a* and **42***b*, and the second accommodating units **42***a* and **42***b* respectively corresponding to the different groups are arranged on and below the first accommodating units **41***a* and **41***b*, respectively.

Thus, the moving distances of the delivery apparatuses **15***a* and **15***b* can be shortened. Therefore, it is possible to increase the number of wafers to be transferred per unit time.

In the above-described example embodiment, there has been explained the case where the multiple cleaning units **16** are divided into two groups, i.e., the upper group G**1** and the lower group G**2**. The cleaning units **16** may be divided into three or more groups. In this case, if the arrangement or the delivering and transferring operations explained in the above example embodiment are applied to at least two adjacent groups, it is possible to increase the number of wafers to be transferred per unit time.

Further, in the above-described example embodiment, there has been explained the case where the inverting units **43***a* and **43***b* configured to invert front and rear surfaces of a wafer W are used as second substrate processing units. The second substrate processing units may be other substrate processing units than the inverting units. By way of example, the second substrate processing units may be inspection units configured to inspect a status of a front surface of a wafer W or may be UV irradiation units configured to irradiate ultraviolet to a wafer W.

Furthermore, in the above-described example embodiment, there has been explained a case where the substrate processing system **1** includes the first accommodating unit **41***a* corresponding to the upper group G**1** and the first accommodating unit **41***b* corresponding to the lower group G**2**. The substrate processing system **1** may include a common first accommodating unit used in both of the upper group G**1** and the lower group G**2**.

New effects or modification examples can be easily conceived by those skilled in the art. For this reason, the invention in its broader aspects is not limited to the specific details and representative example embodiment shown and described herein. Accordingly, various changes and modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

We claim:

1. A substrate processing system comprising:

a first transfer apparatus configured to unload substrates from a cassette that accommodates the substrates and configured to transfer the unloaded substrates in a transfer direction;

at least one first accommodating unit configured to accommodate the substrates transferred by the first transfer apparatus;

multiple first substrate processing units, which are divided into at least two groups and arranged in a height direction, configured to perform a preset process to the respective substrates;

multiple second accommodating units, which each respectively corresponds to one of the groups and are arranged to be parallel with the at least one first accommodating unit in the height direction, configured to accommodate the substrates;

multiple second transfer apparatuses, each respectively corresponding to one of the groups, configured to unload the substrates from the second accommodating units corresponding to the same groups and transfer the substrates into the first substrate processing units belonging to the same groups;

multiple second substrate processing units, which each respectively corresponds to one of the groups and are arranged to be disposed above and below the at least one first accommodating unit and the second accommodating units in the height direction, configured to perform a predetermined process to the respective substrates; and

at least one delivery apparatus configured to deliver the substrates between the at least one first accommodating unit and the second accommodating units and configured to transfer the substrates between the at least one first accommodating unit and the second substrate processing units,

wherein the at least one first accommodating unit corresponding to two adjacent groups is arranged at a middle height position between the two groups, and the second accommodating units respectively corresponding to the groups are arranged above and below the at least one first accommodating unit, respectively,

the at least one delivery apparatus is plural in number, and the delivery apparatuses respectively correspond to the groups, and

the delivery apparatuses deliver the substrates accommodated in the at least one first accommodating unit to the second accommodating units corresponding to the same groups, respectively, wherein the delivery apparatuses deliver the substrates only perpendicular to the transfer direction.

2. The substrate processing system of claim **1**,

wherein the at least one delivery apparatus delivers the substrates accommodated in the at least one first accommodating unit to the second accommodating units when the preset process is performed by the first substrate processing units without performing the predetermined process by the second substrate processing units, and transfers the substrates accommodated in the at least one first accommodating unit into the second substrate processing units when the preset process is performed by the first substrate processing units after the predetermined process is performed by the second substrate processing units, and

the second transfer apparatuses unload the substrates accommodated in the second accommodating units and transfer the substrates into the first substrate processing units when the preset process is performed by the first substrate processing units without performing the predetermined process by the second substrate processing units, and transfer the substrates accommodated in the second substrate processing units into the first substrate processing units when the preset process is performed by the first substrate processing units after the predetermined process is performed by the second substrate processing units.

3. The substrate processing system of claim **2**,

wherein the at least one first accommodating unit is plural in number,

the first accommodating units respectively correspond to the groups and are stacked in multiple stages,

the first transfer apparatus transfers the substrates to be processed in the first substrate processing units into the first accommodating units corresponding to the group to which the first substrate processing units belong, and

the delivery apparatuses deliver the substrates accommodated in the first accommodating units corresponding to the same groups to the second accommodating units corresponding to the same groups or transfer the substrates to the second substrate processing units.

4. The substrate processing system of claim **1**,

wherein the at least one first accommodating unit is plural in number,

the first accommodating units respectively correspond to the groups and are stacked in multiple stages,

the first transfer apparatus transfers the substrates to be processed in the first substrate processing units into the first accommodating units corresponding to the group to which the first substrate processing units belong, and

the delivery apparatuses deliver the substrates accommodated in the first accommodating units corresponding to the same groups to the second accommodating units corresponding to the same groups or transfer the substrates to the second substrate processing units.

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